April 23, 2012
Nuclear Emergency Response Headquarters
Government-TEPCO Mid-and-long Term response Council
Working Council
(Provisional translation)

Progress Status of Mid-and-long Term Roadmap towards the Decommissioning of Fukushima Daiichi Nuclear Power Units 1-4, TEPCO

1. Past One Month Summary and Future Plans

1) Plans to Maintain Plants' Cold Shutdown Conditions

➢ Installation of Alternative Thermometer at the Unit 2 RPV

Alternative to the broken Unit 2's thermometers has been considered. Piping dimensions and piping surface temperatures have been investigated on Mar. 28 (refer to Fig. 1). The results of mock-up tests based on the investigation have shown that we could install an alternative thermometer by application of existing technologies. Decontamination/ shielding will be completed by the end of May and installation will start from Jul.

➢ Designing the Advanced Liquid Processing System (ALPS)

Introduce ALPS, which will bring the radioactivity concentration (α/β nuclides) in the processed water to an even lower level. Foundation works have been conducted since Apr. 1 and after its completion, the installation of the ALPS will follow. Based on the preliminary tests until March, designing in detail is ongoing. Confirmatory tests are planned and the whole installation work schedule is under consideration as well.

➢ Prevent Groundwater leaking into the Reactor Building

・Before drawing up sub-drain, water purification tests at some pits around Units 1-4 are ongoing (until the end of May). Radioactive and deposits/floating materials in the sub-drain are removed during purification tests, and water in some pits will be purified before long. Purification tests of other pits will follow.

・In addition to sub-drain restoration, Groundwater bypass* is considered (refer to Fig. 2).

*Means to reduce groundwater leak into Units 1-4 buildings by pumping up groundwater at their upstream area, changing groundwater flow, and lowering groundwater level around the buildings.

➢ Improve reliability of Water Processing Facility

Investigation of the causes of water leakages from RO (reverse osmosis) concentrated water transfer piping and implementation of leakage-prevent measures is ongoing. Piping connecting to RO system is being replaced to PE (polyethylene) piping. (Main piping for RO concentrated water transfer has been replaced to PE piping (by Apr. 18). Some of main rout piping will be replaced by the end of Apr. and by the end of May for the rest).

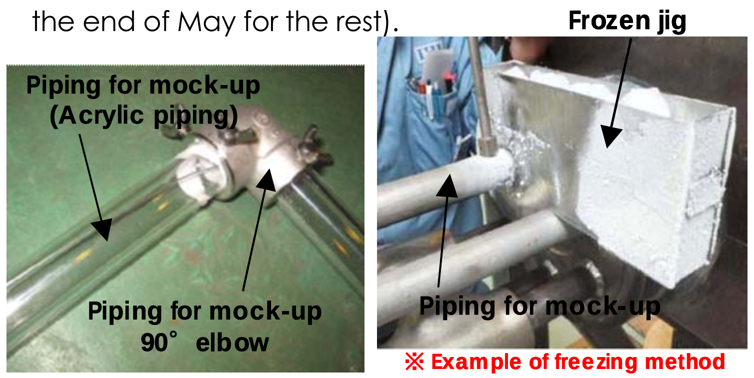


Fig. 1: Mock-up test for installing alternative RPV thermometers

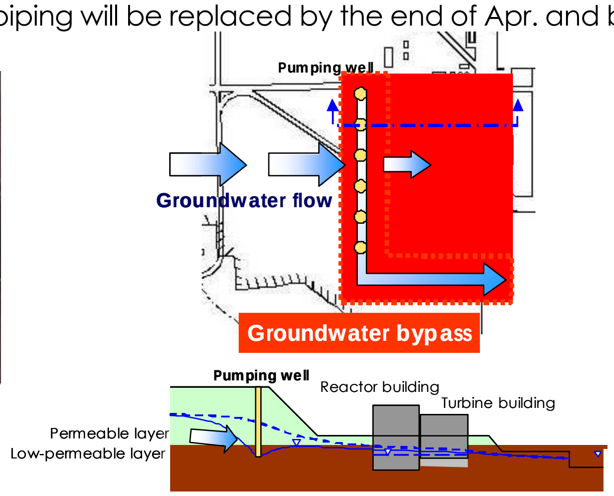


Fig. 2: Groundwater bypass (Image)

2) Plans to Reduce Overall Onsite Radiation Dosage and Mitigate Contamination

➢ Additional Countermeasures for Mitigating Contamination

The seabed soil in front of the intake channel will be covered and solidified. In front of Units 1-4 intake channel, the first layer covering was finished on Mar. 29 and the second layer covering is ongoing (from Apr. 5 to the beginning of May). In front of Units 5 and 6, after installation of additional silt-fences (from the beginning of May to the mid May), covering work will be conducted (from the mid May to the end of Jun.)

➢ Reducing Effective Radiation Dosage at Site Boundaries

・In order to reduce the radiation dosage at the site boundaries, covering the bottom with a water shielding sheet was finished as one of the preparation works for building temporary rubble storage facilities (from Feb. 13 to the end of May), and setting protective soil is ongoing.

・In order to improve the accuracy of detecting radioactive emissions at the Monitoring Post (MP), the environment around MP was improved by cutting trees away, removing the surface soil, and building a shielding wall (from Feb. 10 to Apr. 18). Except for MP-1 (unnecessary to improve), the target level (below 10μGy/h) at all MP 2-8 (as of Apr. 16) was achieved.

・The exposure dose per year at the site boundaries is estimated through aerial waste and solid waste (temporary stored) as of Apr. to be approx. 5.8mSv/y at the maximum (northwest site boundary).

➢ Scattered Rubble Investigation

In order to investigate the scattered rubble situation, a walk around the site grounds from the center of Units 1-4 to the site boundaries was done (Mar. 27, 28). Five materials found around the 500m radius from the center were estimated to be the scattered rubble. The result shows that rubble must be within the site. Witness reports of airborne materials outside of the site will be investigated.

➢ Planning of the Whole Decontamination of the Site

In order to reduce the workers' exposure dose, improve the work efficiency and mitigate contamination, a decontamination plan of accumulated radioactive materials in the site, starting from areas where many workers work with consideration of stay time and dose level, was made.

➢ Monitoring of fishery product within 20km radius

From Mar. to Jun., radioactive concentration of fishery product (as well as seawater and seabed soil) within 20km radius offshore from the site was analyzed once a month at 10 points. The radiation level of young lance fish and Ishikawa ice fish sampled on Mar. 29 were below radioactive standard of food (Total of Cs-134 and 137: 100Bq/kg). The analysis of those outside 20km radius was similar. Among sea bass etc. sampled on Apr. 7, radiation levels of many samples were beyond this standard.

3) Fuel Removal from Spent Fuel Pools

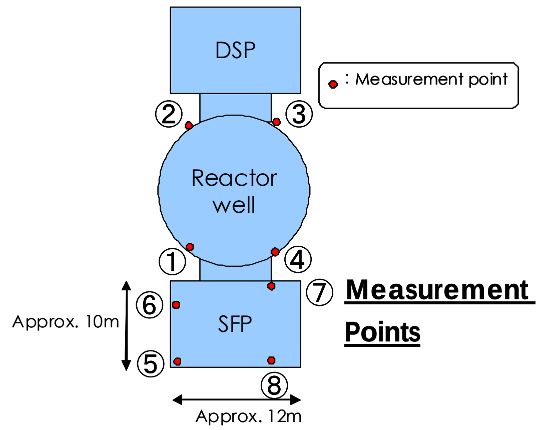
➢ Confirmation of Unit 4 Reactor Building Soundness

In light of starting installation work of the cover for fuel removal at Unit 4 (Apr. 17), the horizontality of spent fuel pool and reactor well was investigated, and the soundness of reactor building was confirmed (Apr. 12) (refer to Fig. 3). The corrosion of spent fuel pool would be prevented by salt removal, hydrazine injection and circulation cooling.

➢ Advanced investigation in Spent Fuel Pool

・In order to make a plan to remove rubble in the Unit 3 spent fuel pool, using remote controlled underwater camera, the pool was investigated (Apr. 13) (refer to Fig. 4). Although there is fallen rubble and the possibility of some damaged fuels, the low radioactive water level indicates it is hardly possible that many spent fuels were damaged.

・Unit 4 has been already investigated and a map of scattered rubble in the pool was made for planning rubble removal. The designing/manufacturing of jigs and tools for rubble removal and rubble removal methods will be considered.



Reactor well	Measured value (last time) (Feb. 7, 2012)	Measured value (this time*) (Apr. 12, 2012)	SFP	Measured value (this time*) (Apr. 12, 2012)
①	462	476	⑤	468
②	463	475	⑥	468
③	462	475	⑦	468
④	464	475	⑧	468

*Water level changes depending on the operation of cooling system.

(Unit: mm)

Elevation differences between Reactor Building Operating Floor and Spent Fuel Pool /and Reactor Well Surface

Fig. 3: Investigation results of horizontality of Spent Fuel Pool and Reactor Well

- ➢ Rubble Clearing from the Upper Part of the Reactor Buildings of Units 3 and 4

  Rubble removal and assembly base installation work continues. Installation of cover for fuel removal at Unit 4 are started, and ground improvement work is ongoing (refer to Fig. 5).

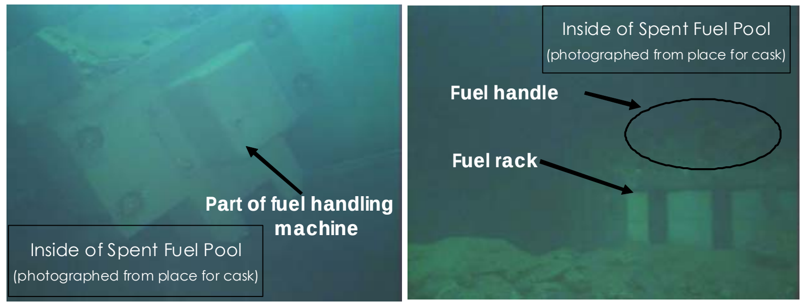


Fig. 4: Investigation of Unit 3 Spent Fuel Pool

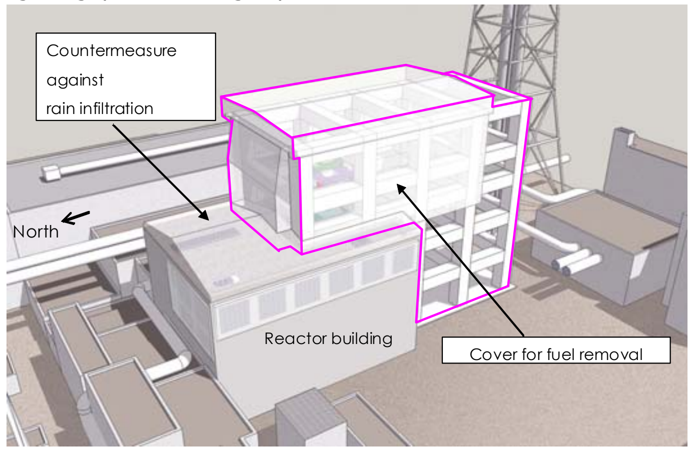


Fig. 5: Image of Unit 4 Cover for Fuel Removal

4) Fuel Debris Removal Plan

- ➢ Decontaminating the insides of the Buildings
  - Investigate contamination situation inside the R/Bs. We practiced an operation of the robot at Fukushima Daini till Apr. 20 and brought it to Fukushima Daiichi on Apr. 23. We will begin investigation of the inside of Unit 1-3's R/B from the middle of May.
  - Plan to conduct decontamination experiments using mock contaminated objects at the middle of Jul. in order to come up with an optimal method in light of each contamination.
- ➢ Inspection and Repair of PCV Leakage Points
  - Researched existing technologies, assumed the water leakage points, and considered methods to investigate and repair those points.
  - Investigated all possible areas in the Torus room by the robot in order to conduct countermeasures against water leakage from PCV, as well as leakage between R/B and T/B on Apr. 18 as referred to in the figure 6.
  - Investigated Unit 3's equipment hatch area with the fiber scope inserted at plug-building interspaces in order to figure out the situation of PCV water leakages on Apr. 19.

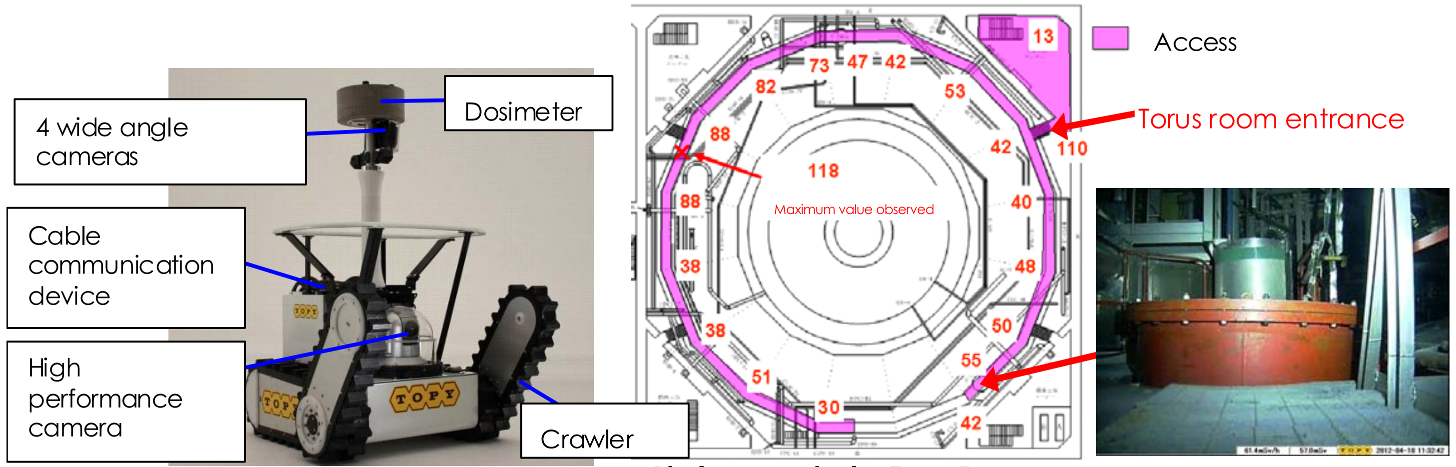


Fig. 6: Outline of investigation at Unit 2 torus room

5) Reactor Facilities Demolition and Radioactive Waste Processing & Disposal

- ➢ Processing & Disposal of Secondary Waste Produced by the Treatment of Contaminated Water
  - Various sorts of characteristic tests for the long-term storage of Secondary Waste are ongoing.
  - The accumulated water and outlet water samples of the water treatment facilities have been delivered to JAEA, who are analyzing the radioactivity density of each type of nuclide in the water (finished Co- 60, Cs-137, Nb-94, Eu-152, Eu-154, H-3, and some of C-14. the analysis plan of other nuclides is under revision as taking time for the pretreatment work).
- ➢ Processing & Disposal of Radioactive Waste
  - Considering sampling and analysis methods of debris etc. Scheduling to start sampling and analyzing around late May.

6) Organization and Staffing Plan

- ➢ Staff Management
  - The necessary manpower (about 2,600) for the May work will be provided.
  - Personnel rotation has been balanced out in consideration of the exposure dosage amounts and quality of onsite work (159 TEPCO employees have been transferred out since last Oct.).
  - The present local employment rate (partner companies' staff) is 72 % as of Mar.
- ➢ Improvements to the Work & Living Environment
  - Held a periodical meeting with our partner companies to improve the work environment (discussed such as beginning vehicle screening at Fukushima Daiichi, improving rest house, and anti-heat-stroke, on Mar. 30). (next monthly meeting is scheduled on Apr. 27).
  - Begun test operations of screening and decontamination of vehicles on the site since Apr. 24.

7) Plan to Secure Worker Safety

- ➢ Continual Employment of Medical Staff

  4 male nurses have been employed since Apr. 1 and they are assigned to the emergency medical room and the clinic at J-village. An organization for continuous medical operation is under consideration.
- ➢ "Uncontroled" status at the Main Anti-earthquake Building

  The dosage reduction measures such as the laying of lead plates on the floors and walls and installing gate-monitor have been implemented at the Main Anti-earthquake Building and will be finished by May 1.
- ➢ Consider and implement countermeasures against heat stroke

  Countermeasures against heat stroke as below (earlier than that of last year)
  - Set the WBGT* number panel (refer to Fig. 7)
  - Arrange work time, rest frequency and time, and work intensity according to WBGT index
  - As a general rule, prohibit working in scorching heat from 2pm to 5pm during Jul. and Aug.
  - Manage appropriate rest frequency and adequate water/salt intake
  - Invest workers with a cooling body wear such as cool vest etc.
  - Conduct workers' health care by check sheet

  *WBGT: The Wet Bulb Globe Temperature indicates a composite temperature. It is used to estimate the effect on humans by temperature, humidity, wind speed (wind chill) and solar radiation.

Fig. 7: Countermeasures against heat (Digital displays)

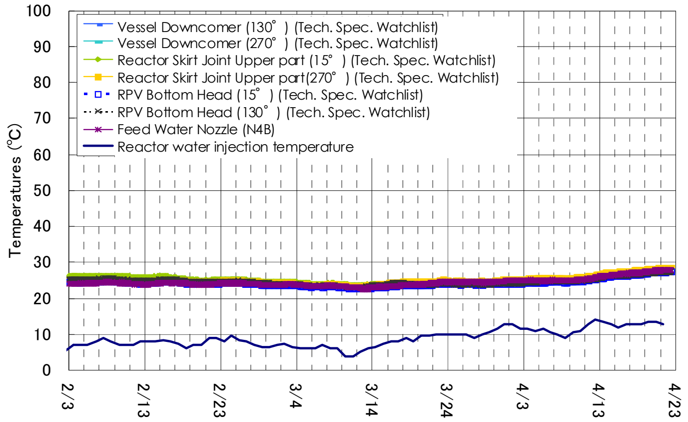
8) Miscellaneous

- ➢ Evaluation and review of R&D projects

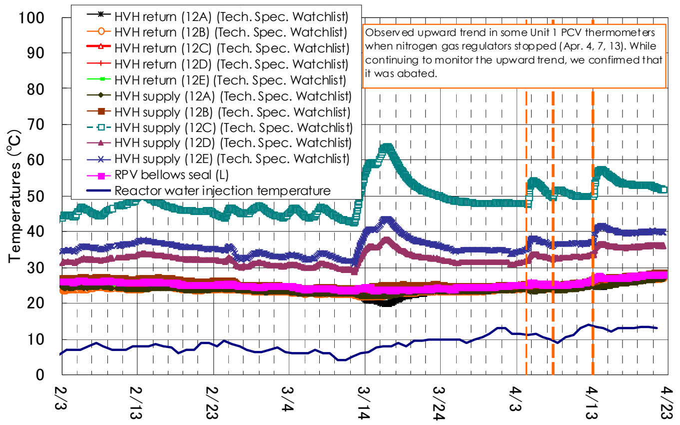
  "2011 evaluation" of each R&D project and "direction of plan review of 2012 R&D project" were completed. Each R&D plan will be reviewed on the bases of these conclusions.

2. Confirming Conditions Equivalent to a Cold Shutdown

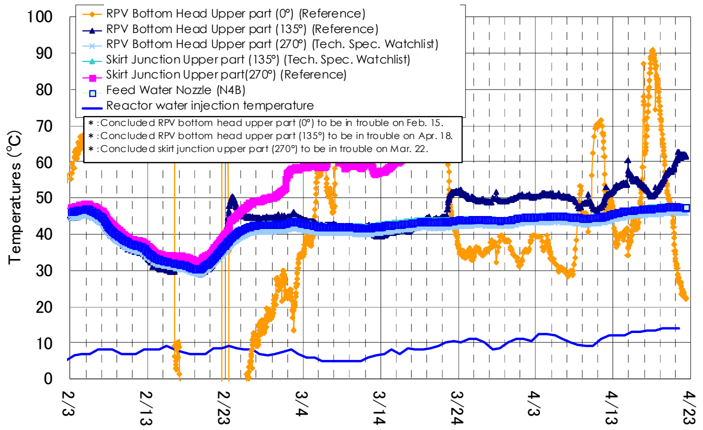
➢Units 1~3's cold shutdown conditions have been maintained; the temperatures at the RPV bottom and in the PCV gaseous part have extremely-mild rising trends between approx. 25 and 60 degrees Celsius (as of Apr. 22). In addition, major parameters such as the PCV pressure and radioactive release rate from the PCV showed no significant changes though PCV pressures trend to rise.



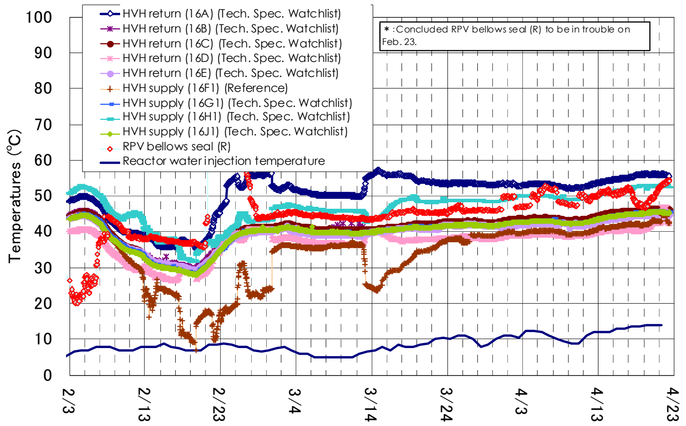
Temperatures pertaining to Unit 1 RPV



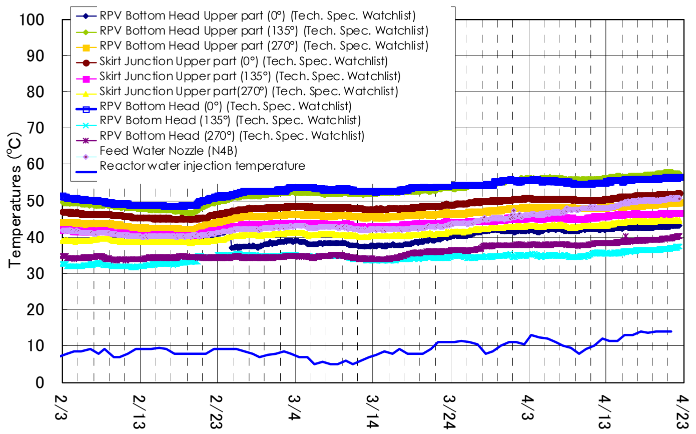
Ambient Temperatures of Unit 1 D/W



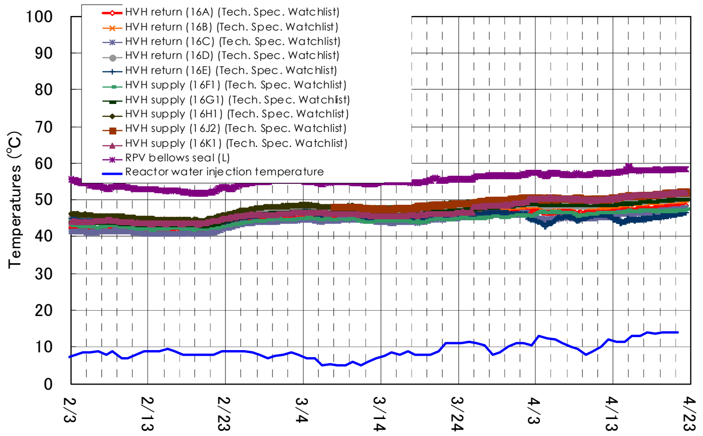
Temperatures pertaining to Unit 2 RPV



Ambient Temperatures of Unit 2 D/W



Temperatures pertaining to Unit 3 RPV

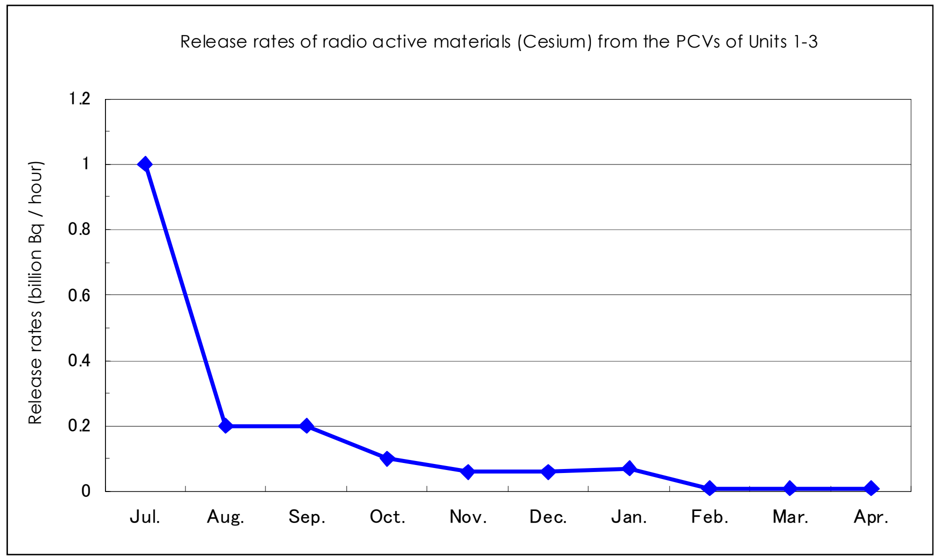


Ambient Temperatures of Unit 3 D/W

- We have periodically monitored the temperatures at the RPV bottom and PCV gaseous part. The trends of these temperatures except some instruments*1,2, are rising mildly due to the injection water temperature's rise. We expect these trends influenced by the atmospheric temperature will continue.

- We also have monitored PCV pressure periodically and confirmed it is mildly rising. We estimate that this pressure rise is caused by downward of the exhaust air volume at the PCV Gas Controlling System compare to N2 injection volume.
- We analyzed the gas inside the PCV gas controlling system by monitoring and sampling noble gas, and confirmed that density of xenon 135 was below 0.1Bq/cm³. This is far below the re-criticality criterion of 1Bq/cm³.

- We estimate that total current release rate of radioactive material (cesium) from the PCVs of Units 1~3 is 0.01 Billion Bq/hour at maximum, calculated from the airborne radioactivity concentration (dust concentration) at the upper parts of the reactor buildings, etc.; approximately 0.0003 Billion Bq/hour at Unit 1, 0.007 Billion Bq/hour at Unit 2 and 0.0002 Billion Bq/hour at Unit 3. The radiation exposure by these emissions per year at the site boundaries is assessed at 0.02 mSv/year, excluding the effects of the radioactive materials so far released.



Furthermore, we are continuously checking the monitoring posts (MP-1~8) and temporary monitoring posts (southern administration building, main gate and west gate), and have so far detected no changes in the radiation dosage at the site boundaries.

*1 On Apr. 4, 7, 13, an upward trend was observed in some of Unit 1's PCV thermometers when the nitrogen gas regulator stopped. While monitoring the trend, we have confirmed that the upward trend was ended and stabilized.

*2 On Apr. 14, the temperature reading of RPV bottom head upper part (135°) at the Unit 2 elevated (from 53.8 ℃ at 8pm to 59.9 ℃ based on the airborne radioactivity concentration (dust concentration) at the upper parts of the reactor buildings, etc. at 9pm). We measured direct current resistance of this thermometer and found it was out of confidence criteria. We measured its direct current resistance on Apr. 18, again and concluded this thermometer was broken.

End